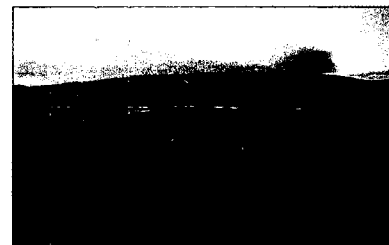


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Soil Erosion and Sediment Control Plan

Source Reduction Remedial Action

L. E. Carpenter & Company
Wharton, New Jersey

USEPA ID No. NJD002168748

September 2004; Revised November 2004

This report and narrative is accompanied by a set of drawings (sheets F1-F6) of the same title. These documents are interrelated and intended to be used and reviewed together.

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Section 1

Introduction

Pursuant to the requirements of the N.J. Soil Erosion and Sedimentation Control Act, Chapter 251, P.L. 1975 this Soil Erosion and Sedimentation Control Plan (SESC Plan) has been prepared for soil remediation activities at the L. E. Carpenter & Company (LEC) site at 170 North Main St. in the Borough of Wharton, Morris County, New Jersey.

Site activities will include initial clearing and grubbing, the excavation and grading of site soils, and the installation of a final surface consisting of a granular soil and topsoil layer. Activities at the site will result in an earth disturbance of greater than 5,000 square feet and therefore an SESC Plan must be developed to minimize the potential for accelerated erosion and sedimentation impacts to surface waters. The Morris County Soil Conservation District requires that this SESC Plan be available for on-site inspection throughout the project construction period.

This SESC Plan has been prepared in accordance with (1) the requirements of Chapter 251 and follows the Standards for Soil Erosion and Sediment Control in New Jersey (NJ SESC Standards) as adopted in July 1999, and (2) the Morris County Soil Conservation District Soil Erosion and Sediment Control Notes and Checklist.

Section 2

Topography

An insert taken from the Dover, New Jersey 7.5 minute U.S.G.S. Quadrangle Map dated 1954, Photorevised 1981, is presented on Figure F1. This map includes relative local features within the vicinity of the site. More detailed site-specific topographic information is presented on Figure F2. Site contours are at one-foot intervals and the plans are at a scale of 1-inch equals 50 or less feet for the folded plans in the pockets of this SESC Plan. The site is adjacent to the northern shore of the Rockaway River just downstream of Washington Forge Pond as shown in the Figures. All surface water runoff from the site drains directly to the adjacent Rockaway River or to a drainage ditch on the east end of the site (see Figure F2). The ditch drains to the Rockaway River approximately 750 feet downstream.

Figure F3 delineates the flood plain areas, the flood way and designated wetlands at the site. The flood limits were determined from the Federal Emergency Management (FEMA) Flood Insurance Agency Rate Map, Community Panel No. 340364 0001B by J. F. New and Associates on behalf of RMT in April 2004, and confirmed by previous projections by RMT from NJDEP Division of Water Resources Flood Hazard Area maps for Wharton Borough (Sheets B-16 and C-16).

Total relief at the site is 14 feet with the highest elevation being along the bike trail that borders the western portion of the source area to be remediated. Natural slopes at the site and within the area to be disturbed average approximately 1.7 percent with a maximum slope of 25 percent immediately adjacent to the drainage ditch. Embankments along the drainage ditch are approximately 5 feet in height. Embankments along the Rockaway River are 1 to 3 feet high.

Any backfill and regrading of surfaces adjacent to or within the 100-year flood plain will result in a net lowering of the ground surface thereby enhancing the flood plain capacity for the 100-year flood. This will be done by first removing portions of the existing impacted soils, and then installing the vegetative cover, so that final grades are at or below currently existing grades over the vast majority of the site. No excavation or filling is planned within the Rockaway River flood way, therefore flood way capacity will not be diminished. Excavation and grading performed in the wetlands will be accomplished in accordance with a Wetlands Permit (Freshwater Wetlands/Open Water Fill Permit General Permit No. 4 – Hazardous Site Investigation and Cleanup, N.J.A.C. 7:7A-5.4) and corresponding Wetlands Mitigation Plan.

Section 3

Soils, Geology, and Cover Description

The USDA-SCS Soil Survey of Morris County indicates soils at the site to be predominantly urban (made) land and Whitman very stony loam. The site is in a glacial outwash valley that was incised through the terminal glacial moraine of Wisconsinan age. Extensive subsurface investigations have been performed over the past ten years at the site and indicate the site to be underlain by cobble-boulder glacial outwash with a thin wedge of siltier coarse-grained alluvium along the east edge and lowland perimeter. The soils are not acidic and do not overlie karstic bedrock.

The site has been heavily disturbed by industrial activities and building demolition such that the land surface is littered with cobbles and remnants of building foundations. Generally the soils on site exhibit lower erosivity than fine-grained silt-based soils. In accordance with Table A-2A of the NJ SESC Standards the soil erodibility class (K-value) is low. Coupled with the low slopes (< 2 percent) the erosion potential on the site is very low. Regardless, erosion control considerations must be conservative on this site to minimize loss of potentially contaminated materials to the surface water and other environmentally sensitive areas (*i.e.*, wetlands systems) during remediation efforts.

Except for areas along the bank of the Rockaway River and the lowland and wetland areas to the east, where the ground is covered by trees, brush and grasses, most of the site is lightly vegetated with scrub growth and saplings and very little grass. This vegetative cover will be significantly improved upon completion of this project. Note that a strip of existing vegetative buffer will be maintained along the Rockaway River during construction.

Section 4

Disturbance Areas

The total area involved in remediation staging, stockpiling, and excavation totals approximately 4.7 acres. The area to be excavated backfilled and regraded is approximately 700 feet long, ranges in width from approximately 50 to 250 feet and comprises an area of approximately 2.7 acres. The limits of disturbance areas are delineated on Figure F4.

The planned remediation activities at the site involve the excavation of approximately 27,000 cubic yards (CY) of soil of which approximately 12,000 CY will be reused as backfill and the remainder that is contaminated with lead, copper, xylene and bis (2-ethylhexyl) phthalate (DEHP) will be removed to off-site licensed disposal facilities.

The disturbed areas are configured to be the minimum possible, given the source removal requirements of the Remedial Action. No changes in configuration could be made to further minimize land disturbance and at the same time achieve source reduction objectives, and long-term goals of groundwater compliance with cleanup criteria by means of natural degradation. The staging area north of the planned excavation area will be accommodated on the old asphalt parking surface that serviced the previously demolished Building 14 formerly located to the south. This area will not be regraded or excavated, and current conceptual plans call for repaving of the area for use as tennis courts by the Borough of Wharton.

Section 5

Site Runoff, Run-on

All disturbed areas fall within the watershed of the Rockaway River. Natural runoff from the site is to the Rockaway River on the south or a tributary drainage ditch on the east via sheet flow. Site drainage divides and surface water runoff directions are delineated on Figure F2. Run-on to the site is limited as the bike trail bordering the west runs along a constructed berm blocking any flow from the west including 100-year floodwaters.

No drainage ways or swales are present through the excavation area, although a drainage ditch exists between LEC and the former Air Products facility to the east. The drainage ditch collects runoff from the paved northern portion of the site that will be used as a staging area during remediation. It is currently planned to divert the southwest corner of the drainage further onto the Air Products site as part of the remediation effort (see Figure F5). The current channel cross-sectional configuration and slope will be maintained, and no impact to the channel capacity is anticipated, as the contributing area will remain the same. Hydraulic conditions of the contributing area to the channel and the sizing of the channel were evaluated. Hydraulic data regarding this channel are included as Appendix A to this SESC Plan. Based on the recommendations of the New Jersey Stormwater Management Practices, the Rational Method was used to analyze runoff from the site along with conservative assumptions for rainfall intensity and runoff coefficients. The drainage area contributing to this segment of the ditch is approximately 2.3 acres of the LEC property and 0.6 acres of the Air Products site. The analysis concluded that the design capacity of the relocated ditch would be approximately 30.8 cfs, far exceeding the estimated storm flow of 2.6 cfs.

All other runoff is to the wetland area to the east or to the Rockaway River. All run-off is by sheet flow. As final topographic surface are not planned to be steepened, and augmentation of existing vegetative cover is planned, no other drainage improvements are deemed necessary.

Silt fencing will be placed along-contour down-slope of all excavation and stockpile areas as shown on Figures F4 and F6 prior to any earth disturbance. In addition, floating turbidity barriers are planned along the Rockaway River and across the drainage directly downstream of immediately adjacent excavation or grading areas (see Figure F4).

Section 6

Construction Sequence and Staging

Initiation of site work is anticipated for the fall of 2004 and is expected to proceed into the spring of 2005, depending on weather and other factors. Construction sequencing will be such that temporary erosion control measures will be established in all impacted areas prior to significant soil disturbances. Additional information pertaining to the location and design of erosion control measures is provided in Sections 7 and 8.

It is important to note that the purpose of this project is to remove from the LEC site contaminated soils that may pose a threat to human health and the environment. This "source" removal action will inherently result in a lowering of topographic grades and elevations at the site, and provide a more erosion resistant ground cover. Only during excavation will the risk of sediment release be heightened. However, this risk will be minimized by the fact that most of the excavation across the site will be conducted within a closed depression that will act as a temporary sediment trap (see Figure F4).

Regardless, the importance of erosion protection and the maintenance of such controls on this site is understood. Erosion controls will be inspected and replaced, if necessary, on a daily basis. General sequencing of the site tasks and erosion and sedimentation control actions will be as follows:

1. At least 7 days before starting any earth disturbance activities, as an agent of the owner, the RMT Construction Manager shall invite all subcontractors involved in those activities and a representative of the Morris County Soil Conservation District to an on-site pre-construction meeting.
2. At least 3 days before any earth disturbance the Construction Manager shall notify the New Jersey One Call System at (800) 272-1000 to locate buried off-site utilities that are entering the property.
3. The stabilized construction entrance to the site will be installed.
4. Site preparation will be initiated and will consist of demolition of the two small treatment buildings (see Figure F4). Note that limited soil disturbance is expected during these activities.
5. Silt fencing will be installed along-contour and down-slope of the excavation and proposed stockpile areas as shown on Figures F4 and F6.

6. Clearing, grubbing, and grading of the silt fence route will be performed concurrently with item 4.
 7. Floating turbidity barriers will be installed along the Rockaway and across the drainage ditch prior to excavation and grading in those areas.
 8. Soil excavation and rough backfill will then proceed as follows (5 month period):
 - Removal from the main body of the excavation area lead- and industrial waste-impacted soils; screening of the soils, removal for off-site disposal of soils less than 2.5 inch, and stockpiling the coarse fraction for reuse as backfill.
 - Removal and off-site disposal of PCB-impacted soils from the lowland area at the east end of the site.
 - Removal and stockpiling for backfill clean soils from the main body of the excavation.
 - Removal of free-product impacted soils from the main body of the excavation to an elevation of approximately 622 feet, processing and screening of the soils and retention of the > 2.5-inch fraction for reuse in backfilling the excavation.
 - Simultaneous backfilling of the excavation with screened material.
 - Rough grading of the excavation and placement of imported granular fill.
 - Placement and fine grading of topsoil.
 9. Seeding, mulching, and fertilization of topsoiled areas will be accomplished in the spring.
 10. After establishment of vegetation, temporary control materials including the silt fence and turbidity barriers will be sequentially removed by the contractor and disposed of at an approved facility.
-

Section 7

Temporary Erosion Control Measures and Facilities

Figures F4 and F6 show the proposed location and details of proposed temporary erosion control measures. Additional information pertaining to specific erosion controls is presented in the attached Construction Specifications.

Design requirements for silt fencing and floating turbidity barriers meet the NJ SESC Standards (see Figure F6 and Section 10) provided by the Morris County Soil Conservation District (see Figure F6). Silt fencing will be installed along the entire southern area of site down slope between the area to be disturbed and the Rockaway River as well as along the drainage ditch bordering the east end of the site, specifically east of the soils staging and screening area. Additional silt fencing will be installed within the lowland and wetland areas east of the excavation. Silt fencing will also be installed down slope of all proposed stockpile areas. The contributing areas above the planned segments of silt fencing are small (< 1 acre) and at a low slope (<2 percent).

No excavation incursion into the Rockaway Flood Way are planned as part of this SESC application, however excavation and grading will occur within the 100-year flood plain, at the east end of the excavation. Protection of the Rockaway River and drainage ditch will be accomplished by means of floating turbidity barriers as located on Figure F4. Should USEPA and NJDEP require removal of contaminated sediments from the Rockaway River, appropriate stream encroachments permits will be acquired.

To eliminate potential tracking of sediment off-site onto public streets, a decontamination pad and stabilized stone entrance will be installed at the exit to the construction zone (See Figures F4 and F6).

Section 8

Best Management Practices and Permanent Control Measures

This source removal remedial action is in itself a Best Management Practice (BMP) for this site, as one of the primary purposes of this action is to remove the potential for direct contact and off-site migration of contaminated soils. The project will incorporate temporary and permanent BMP elements. Temporary BMP elements including the use of silt fences, floating turbidity barriers, a stabilized construction entrance, and a decontamination pad will be utilized throughout construction.

The soil cover system including topsoil, seed, and mulch, will serve as a permanent control measure once vegetation is established. Following final grading, the topsoil will be seeded, fertilized and mulched in accordance with the Specifications included as part of this SESC Plan. The proposed final grading plan with a conceptual end use for the site is shown on Figure F5. Details of other design features and grading cross-sections are shown on Figures F4 and F6.

The end use plan is conceptual and intended to meet the needs for the site based on initial discussions with the Borough of Wharton. The grassed and paved surfaces accompanying the proposed athletic park will be a major environmental improvement to the existing site conditions. In addition, disturbance to existing vegetative buffers along the Rockaway River and the drainage ditch will be minimized during remediation, such that this protective buffer will be maintained during and after completion of the source reduction project. It is also believed that the marginal wetland area at the east end of the site will be better suited to wetland development after remediation and will provide an additional buffer to the site as well as an enhanced wetland habitat. Restorative and post remedial monitoring measures proposed for the wetland area will be outlined in the Wetland Mitigation Plan.

No storm water collection system or outfalls will be necessary for the final design. Therefore, long-term maintenance requirements for the site should be met by the normal maintenance that is customary with the upkeep of a baseball field and other ancillary park features (*i.e.*, asphalt inspection and repair of walkways, grass maintenance, garbage collection, etc).

Section 9

Maintenance Program

Some silt fencing may be temporarily removed and replaced on a daily basis to permit grading or access. Temporary erosion control measures will be inspected daily during construction and documented in daily field records. Silt fencing will be reinforced or replaced when silt reaches 50 percent of the fence height. Additional measures will be taken to minimize erosion and sedimentation as necessary. Restored areas will be remulched and reseeded as necessary to establish a vegetative cover over disturbed areas as shown on Figure F6, and the Construction Specifications (Section 10).

Until the site is stabilized, all erosion and sediment BMPs will be maintained properly. Maintenance will include inspections of all erosion and sediment BMPs after each runoff event and on a weekly basis.

The stabilized construction entrance will be redressed as necessary to prevent potentially contaminated materials from leaving the site. Any soil or mud accumulating on the bike trail will be removed and placed back in appropriate stockpile area(s). All preventative and remedial maintenance work, including clean out, repair, replacement, regrading, reseeding, remulching, and renetting must be performed immediately. If erosion and sediment control BMPs fail to perform as expected, replacement BMPs or modifications of those installed will be implemented and the Morris County Soil Conservation District will be updated.

After establishment of vegetation, temporary control materials will be sequentially removed and disposed of at an approved facility. As the current intent is to turn this property over to the Borough of Wharton for use after remediation, it is understood that that the Borough will be responsible for continued erosion and sedimentation control maintenance measures separate from those outlined in this SESC Plan, and that the Borough may be required to file an additional SESC Plan with Morris County at that time.

Section 10

Construction Specifications

10.1 General

Except as modified within this SESC Plan the construction specifications for erosion and sedimentation control materials and installation requirements are as outlined below.

10.2 Sediment Control (Silt) Fence

Silt fencing shall be installed at the locations shown on the SESC Plan Figure F4 and as follows:

10.2.1 Materials

Materials for sediment control fencing shall be as manufactured by:

- Mirafi Civil Engineering Fabrics
P.O. Box 240967
Charlotte, NC 28224
- CONTECH Construction Products
Fenton Street
Palmer, MA 01069
- Synthetic Industries
Geosynthetic Products Division
4019 Industry Drive
Chattanooga, TN 37416

10.2.2 Installation

- Install hardwood posts 2 feet below grade, at maximum 8-foot spacing.
- Anchor bottom 6 inches of fence netting below grade to create a continuous toe-in structure along fence installation.
- Install fence in areas designated on Figure F4.

10.3 Floating Turbidity Barrier

Floating turbidity barriers shall be installed at the locations shown on the SESC Plan Figure F4 and as follows:

10.3.1 Design Criteria

As provided by:

- Brockton Equipment/Spill Dam, Inc.
P.O. Box 3219
Brockton, MA 02404

Or similar, having:

- Fabric skirt of geotextile filter fabric
- Minimum 5/16-inch galvanized chain ballast
- PVC-coated polyester floatation cover with heat sealed pockets
- Top tension cable will be minimum 5/16-inch diameter

10.3.2 Placement

- Barrier along Rockaway River will extend parallel to the north bank of the channel for the full distance of the zone of disturbance adjacent to the channel and as shown on Figure F4.
- Barrier across the drainage channel will extend across the entire width of the channel.

10.4 Topsoil

Areas that have been excavated, regarded, and prepared for vegetative cover are to be topsoiled as follows, unless they are areas designated for wetland restoration in accordance with the Wetlands Mitigation Plan:

10.4.1 Materials

- Friable, fertile, loamy soil containing 2.75 percent organic matter and capable of sustaining healthy plant life.
- Free from refuse, subsoils, materials toxic to plant growth, and foreign objects.

10.4.2 Preparation

1. Remove vegetation, foreign materials, unsatisfactory or contaminated soils, obstructions, and matter harmful to plant growth from ground surface before placement.
2. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
3. Scarify subsoil to a depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

10.4.3 Placement

1. Handle topsoil only when dry enough to work without damaging soil structure.
2. Place Topsoil to a uniform depth of 5 inches.
3. Finish grade to match with existing grades.
4. Break down clods and lumps.

If necessary, adjust soil pH to approximately 6.5 by disking limestone to a depth of 4 inches as is practicable.

10.5 Seeding

Those areas designated for topsoil and seeding will be seeded as follows unless specified otherwise in agreement with the Borough of Wharton.

10.5.1 Seed Mixture

- Hard Fescue: 120 lbs per acre
- Kentucky Blue Grass: 40 lbs per acre
- Perennial Ryegrass: 30 lbs per acre

10.5.2 Accessories

- Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
- Water: Clean, fresh, and free of substances or matter, which could inhibit vigorous growth of grass.

10.5.3 Preparation of Topsoil

1. Grade topsoil to finish grades to ensure positive drainage.
2. Remove stones or objects over 2 inches in diameter, foreign materials, weeds, and undesirable plants and their roots.
3. Apply fertilizer immediately before seeding in accordance with Section 10.6.

10.5.4 Application

1. Apply seed at a rate specified by the mix outlined above evenly in two intersecting directions. Fine rake in place.
2. Do not sow immediately following rain, or when ground is too dry, or during windy periods.
3. Seeding may be accomplished between March 1 and November 15.

10.5.5 Hydroseeding

1. A hydroseeder may be used if deemed more appropriate for seeding, particularly for slopes. If used, the hydroseeder shall have continuous agitating action that keeps the seed uniformly mixed in the slurry until pumped from the tank.
2. Apply seeded slurry at a rate of 100 pounds of seed and 100 pounds of fertilizer per 1,000 square feet evenly in two intersecting directions, with a hydraulic seeder. Do not hydroseed area in excess of that which can be mulched on the same day.

10.5.6 Mulching

1. Apply mulch to the seeded area at a rate of 50 pounds per 1000 square feet.
2. Immediately following mulching, roll-mulched area. On large areas, a cultipacker may be used to roll and cover the seed.

10.5.7 Watering

1. Apply water with a fine spray immediately after each area has been mulched. Saturate soil to a depth of 4 inches.
2. Keep the surface layer of soil damp by frequent light watering with a fine spray during the germination period when rainfall is insufficient.

10.5.8 Germination

All seeding work shall be maintained until full germination is accomplished. If required, resoil, reseed, and refertilize until a satisfactory stand of grass is accomplished.

10.6 Fertilizing

10.6.1 Fertilizer Mixture

Fertilizer is recommended for grass, with fifty percent of the elements derived from organic sources; to the following proportions: Nitrogen 18 percent, phosphoric acid 24 percent, soluble potash 5 percent.

10.6.2 Execution

1. Apply fertilizer in accordance with manufacturer's instructions.
2. Apply after topsoil is raked smooth and prior to roller compaction.
3. Do not apply fertilizer at same time or with same machine that will be used to apply seed.
4. Mix thoroughly into upper 2 inches of topsoil.
5. Lightly water to aid the dispersion of fertilizer.

Appendix A

Hydraulic Data

Appendix A

As part of the remediation project a segment of the existing drainage ditch will be diverted (Figure F5). No other changes will be made that affect the runoff of the site. As seen in the figure, the new segment of drainage ditch will reduce the existing ditch in one corner. The dimensions, vegetation, and slope of the new segment of drainage ditch will remain consistent with the existing ditch.

The Rational Method was used to determine the potential peak flow for a 10-year storm for flow traveling to this ditch. The peak flow was calculated as 2.56 cfs. The calculations are included in this Appendix. The capacity of the existing ditch including the segment of ditch that will be reconstructed was calculated as 30.8 cfs, which is much greater than the expected peak flow.

The ditch construction and dimensions were compared to the requirements in the "Standards for Soil Erosion and Sedimentation Control in New Jersey" (Manual). The vegetative retardance factor for the ditch is D, which meets the requirements for capacity and allowable velocity. (The minimum for capacity (Q) is D and the maximum for velocity is E for grassed water ways 18-3 of the Manual). Based upon Figure A6-3 of the Manual, a hydraulic radius of 1.1 ft, and a slope of 0.02%, the velocity is approximately 1.4 fps. A maximum velocity of 1.4 fps meets the maximum allowable velocity requirements in Table 18-1 of the Manual for any soil type. A summary calculation sheet is also included in this Appendix.

The dimensions of the ditch also meet requirements of Section 18-3 of the Manual (Grass Waterways). The new segment of ditch will measure approximately 20 ft. across, which is within the minimum and maximum top widths of 10 ft. and 50 ft., respectively. The cross section will be trapezoidal with a base width of approximately 2 ft., side slopes of 4.5 ft (horizontal over vertical), and depth of 2 ft. There will be no new point discharge from the new segment of ditch. The new ditch will simply connect the existing ditch there by removing a corner of the existing ditch.

RMT, Inc.
Grass Channel Sizing Calculations

Site: LE Carpenter
Project #: 6527.01
Channel : Existing Ditch

Date: September 15, 2004
User: Herner

I. Input Parameters.

A. Side slope, Z1 (hor/vert) = 4.500 ft/ft
B. Side slope, Z2 (hor/vert) = 4.500 ft/ft
C. Bottom width, B = 2.000 ft
D. Design channel slope, S = 0.002 ft/ft
E. Channel Peak Flow, Q = 30.790 cfs
F. Enter - 1 - for Type "C" Veg. Retardence 2
 - 2 - for Type "D" Veg. Retardence

II. Peak Flow Calculations.

A. Trial flow depth, D = 2.000 ft
 (Bisection method until $V_a = V_b$)
B. Channel flow area, $A_c =$ 22.000 sq ft
 $(.5 * Z1 * D^2) + (B * D) + (.5 * Z2 * D^2)$
C. Wetted Perimeter, $P_w =$ 20.439 ft
 $(D * (Z1^2 + 1)^{.5}) + B + (D * (Z2^2 + 1)^{.5})$
D. Hydraulic radius, $R_h =$ 1.076 ft
 (A_c / P_w)
E. Velocity and hydraulic radius, $V_R =$ 1.506 sfps
 $(V_a * R_h)$
F. Channel flow Manning's coeff, $n_c =$ 0.050
 0
G. Trial velocity, $V_a =$ 1.400 fps
 (Q / A_c)
H. Resultant velocity, $V_b =$ 1.400 fps
 $(1.49 / n_c) * (R_h^{.667}) * (S^{.5})$

Invoke Solution Macro by typing - 'ctrl' D

RMT, Inc.
Flow Calculations

Site: LE Carpenter

Project #: 6527.01

Calculation: Contributing Flow to Exist and proposed relocated ditch segment

Date: September 15, 2004

By: H. Herner

Assumptions:

Area 1 (LE. Carpenter subwatershed) = 2.3 acres

Area 2 (Air Products subwatershed) = 0.6 acres

C = Runoff Coef = 0.8 asphalt (~50% of Area 1)
 = 0.2 dirt/slight grass (~50% of Area 1 and all of Area 2)

Rainfall Intensity (I) = 2 in/hr (conservative value)

Use Rational Method: (per NJ Stormwater Best Management Practices Manual,
February 2004, for areas < 20 acres)

Use conversion value of 1.008

$Q = CiA (1.008) = \text{Peak Flow}$

$$Q = [(0.5)(0.8) + (0.5)(0.2)][2 \text{ in/hr}][2.3 \text{ acre}] 1.0008 \\ + [0.2][2 \text{ in/hr}][0.6 \text{ acre}] 1.008$$

$$Q = 2.32 + 0.24 = 2.56 \text{ cfs}$$

Conclusion:

$Q \ll \text{design flow of } 30.8 \text{ cfs}$



Appendix B

Additional NJ-SESC Specifications



**STANDARD
FOR
PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION**

Definition

Establishment of permanent vegetative cover on exposed soils where perennial vegetation is needed for long term protection.

Purpose

To permanently stabilize the soil, assuring conservation of soil and water, and to enhance the environment.

Water Quality Enhancement

Slows the over land movement of stormwater runoff, increases infiltration and retains soil and nutrients on site, protecting streams or other stormwater conveyances.

Where Applicable

On exposed soils that have a potential for causing off-site environmental damage.

Methods and Materials

1. Site Preparation

- A. Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and mulch anchoring. All grading should be done in accordance with Standards for Land Grading, p. 19-1.
- B. Immediately prior to seeding and topsoil application, the surface should be scarified 6" to 12" where there has been soil compaction. This practice is permissible only where there is no danger to underground utilities (cables, irrigation systems, etc.).
- C. Install needed erosion control practices or facilities such as diversions, grade stabilization structures, channel stabilization measures, sediment basins, and waterways. See Standards 11 through 42.

2. Seedbed Preparation

- A. Apply ground limestone and fertilizer according to soil test recommendations such as offered by Rutgers Co-operative Extension. Soil sample mailers are available from the local Rutgers Cooperative Extension offices. Fertilizer shall be applied at the rate of 500 pounds per acre or 11 pounds per 1,000 square feet of 10-20-10 or equivalent with 50% water insoluble nitrogen unless a soil test indicates otherwise. Apply limestone in accordance with Table 4-1, pg 4-2 and the results of soil testing. Calcium carbonate is the equivalent and standard for measuring the ability of liming materials to neutralize soil acidity and supply calcium and magnesium to grasses and legumes. Table 4-1 is a general guideline for limestone application rates.

Table 4-1

Limestone ¹ Application Rate by Soil Texture		
SOIL TEXTURE	TONS/ACRE	LBS./1000 SQ. FT.
Clay, clay loam, and high organic soil	3	135
Sandy loam, loam, silt loam	2	90
Loamy sand, sand	1	45

1. Pulverized dolomitic limestone is preferred for most soils south of the New Brunswick-Trenton line.

- B. Work lime and fertilizer into the soil as nearly as practical to a depth of 4 inches with a disc, springtooth harrow, or other suitable equipment. The final harrowing or disking operation should be on the general contour. Continue tillage until a reasonable uniform seedbed is prepared.
- C. Immediately prior to seeding, the surface should be scarified 6" to 12" where there has been soil compaction. This practice is permissible only where there is no danger to underground utilities (cables, irrigation systems, etc.).
- D. High acid producing soil.

Soils having a pH of 4 or less or containing iron sulfide shall be covered with a minimum of 12 inches of soil having a pH of 5 or more before initiating seedbed preparation. See Standard for Management of High Acid Producing Soils, pg. 1-1.

3. Seeding

- A. Select a mixture from Table 4-3 (pg. 4-7) or use mixture recommended by Rutgers Cooperative Extension or Natural Resources Conservation Service which is approved by the Soil Conservation District. Seed germination shall have been tested within 12 months of the planting date. No seed shall be accepted with a germination test date more than 12 months old unless retested.
 - 1. Seeding rates specified are required when a report of compliance is requested prior to actual establishment of permanent vegetation. Up to 50% reduction in rates may be used when permanent vegetation is established prior to a report of compliance inspection. These rates apply to all methods of seeding. Establishing permanent vegetation means 80% vegetative coverage with the specified seed mixture for the seeded area and mowed once.
 - 2. Warm season mixtures are grasses and legumes which maximize growth at high temperatures, generally 85° F and above. See Table 4-3 (pg.4-7), mixtures 1 to 7. Planting rates for warm season grasses shall be the amount of Pure Live Seed (PLS) as determined by germination testing results.
 - 3. Cool Season Mixtures are grasses and legumes which maximize growth at temperatures below 85°F. Many grasses become active at 65°F. See Table 3, mixtures 8-20. Adjustment of planting rates to compensate for the amount of Pure Live Seed is not required for cool

season grasses.

- B. **Conventional Seeding** is performed by applying seed uniformly by hand, cyclone (centrifugal) seeder, drop seeder, drill or cultipacker seeder. Except for drilled, hydroseeded or cultipacked seedings, seed shall be incorporated into the soil within 24 hours of seedbed preparation to a depth of 1/4 to 1/2 inch, by raking or dragging. Depth of seed placement may be 1/4 inch deeper on coarse textured soil.
- C. **Hydroseeding** is a broadcast seeding method usually involving a truck or trailer mounted tank, with an agitation system and hydraulic pump for mixing seed, water and fertilizer and spraying the mix onto the prepared seedbed. Mulch shall not be included in the tank with seed. Short fibered mulch may be applied with a hydroseeder following seeding. (also see Section IV Mulching below) Hydroseeding is not a preferred seeding method because seed and fertilizer are applied to the surface and not incorporated into the soil. Poor seed to soil contact occurs reducing seed germination and growth. Hydroseeding may be used for areas too steep for conventional equipment to traverse or too obstructed with rocks, stumps, etc.
- D. After seeding, firming the soil with a corrugated roller will assure good seed-to-soil contact, restore capillarity, and improve seedling emergence. This is the preferred method. When performed on the contour, sheet erosion will be minimized and water conservation on site will be maximized.

4. Mulching

Mulching is required on all seeding. Mulch will insure against erosion before grass is established and will promote faster and earlier establishment. The existence of vegetation sufficient to control soil erosion shall be deemed compliance with this mulching requirement.

- A. **Straw or Hay.** Unrotted small grain straw, hay free of seeds, or salt hay to be applied at the rate of 1-1/2 to 2 tons per acre (70 to 90 pounds per 1,000 square feet), except that where a crimper is used instead of a liquid mulch-binder (tackifying or adhesive agent), the rate of application is 3 tons per acre. Mulch chopper-blowers must not grind the mulch. Hay mulch is not recommended for establishing fine turf or lawns due to the presence of weed seed.

Application. Spread mulch uniformly by hand or mechanically so that approximately 85% of the soil surface will be covered. For uniform distribution of hand-spread mulch, divide area into approximately 1,000 square feet sections and distribute 70 to 90 pounds within each section.

Anchoring shall be accomplished immediately after placement to minimize loss by wind or water. This may be done by one of the following methods, depending upon the size of the area, steepness of slopes, and costs.

1. **Peg and Twine.** Drive 8 to 10 inch wooden pegs to within 2 to 3 inches of the soil surface every 4 feet in all directions. Stakes may be driven before or after applying mulch. Secure mulch to soil surface by stretching twine between pegs in a criss-cross and a square pattern. Secure twine around each peg with two or more round turns.
2. **Mulch Nettings** - Staple paper, jute, cotton, or plastic nettings to the soil surface. Use a degradable netting in areas to be mowed.

3. Crimper (mulch anchoring coulter tool) - A tractor-drawn implement, somewhat like a disc harrow, especially designed to push or cut some of the broadcast long fiber mulch 3 to 4 inches into the soil so as to anchor it and leave part standing upright. This technique is limited to areas traversable by a tractor, which must operate on the contour of slopes. Straw mulch rate must be 3 tons per acre. No tackifying or adhesive agent is required.
4. Liquid Mulch-Binders - May be used to anchor salt hay, hay or straw mulch.
 - a. Applications should be heavier at edges where wind may catch the mulch, in valleys, and at crests of banks. The remainder of the area should be uniform in appearance.
 - b. Use one of the following:
 - (1) Emulsified asphalt - (SS-1, CSS-1, CMS-2, MS-2, RS-1, RS-2, CRS-1, and CRS-2). Apply 0.04 gal./sq./yd. or 194 gal./acre on flat areas and on slopes less than 8 feet or more high, use 0.075 gal./sq. yd. or 363 gal./acre. These materials may be difficult to apply uniformly and will discolor surfaces.
 - (2) Organic and Vegetable Based Binders - Naturally occurring, powder based, hydrophilic materials when mixed with water formulates a gel and when applied to mulch under satisfactory curing conditions will form membraned networks of insoluble polymers. The vegetable gel shall be physiologically harmless and not result in a phytotoxic effect or impede growth of turfgrass. Use at rates and weather conditions as recommended by the manufacturer to anchor mulch materials. Many new products are available, some of which may need further evaluation for use in this state.
 - (3) Synthetic Binders - High polymer synthetic emulsion, miscible with water when diluted and following application to mulch, drying and curing shall no longer be soluble or dispersible in water. It shall be applied at rates recommended by the manufacturer and remain tacky until germination of grass.

Note: All names given above are registered trade names. This does not constitute a recommendation of these products to the exclusion of other products.

- B. Wood-fiber or paper-fiber mulch - shall be made from wood, plant fibers or paper containing no growth or germination inhibiting materials, used at the rate of 1,500 pounds per acre (or as recommended by the product manufacturer) and may be applied by a hydroseeder. This mulch shall not be mixed in the tank with seed. Use is limited to flatter slopes and during optimum seeding periods in spring and fall.
- C. Pelletized mulch - compressed and extruded paper and/or wood fiber product, which may contain co-polymers, tackifiers, fertilizers and coloring agents. The dry pellets, when applied to a seeded area and watered, form a mulch mat. Pelletized mulch shall be applied in accordance with the manufacturers recommendations. Mulch may be applied by hand or mechanical spreader at the rate of 60-75 lbs/1,000 square feet and activated with 0.2 to 0.4 inches of water. This material has been found to be beneficial for use on small lawn or renovation areas, seeded areas where weed-seed free mulch is desired or on sites where straw mulch and tackifier agent are not practical or desirable.

Applying the full 0.2 to 0.4 inches of water after spreading pelletized mulch on the seed bed is extremely important for sufficient activation and expansion of the mulch to provide soil coverage.

5. Irrigation (where feasible)

If soil moisture is deficient, and mulch is not used, supply new seedlings with adequate water (a minimum of 1/4 inch twice a day until vegetation is well established). This is especially true when seedlings are made in abnormally dry or hot weather or on droughty sites.

6. Topdressing

Since slow release nitrogen fertilizer (water insoluble) is prescribed in Section II. A. Seedbed Preparation in this Standard, no follow-up of topdressing is mandatory. An exception may be made where gross nitrogen deficiency exists to the extent that turf failure may develop. In that instance, topdress with 10-10-10 or equivalent at 400 pounds per acre or 10 pounds per 1,000 square feet.

7. Establishing Permanent Vegetative Stabilization

The quality of permanent vegetation rests with the contractor. The timing of seeding, preparing the seedbed, applying nutrients, mulch and other management are essential. The seed application rates in Table 4-3 (pg. 4-7) are required when a Report of Compliance is requested prior to actual establishment of permanent vegetation. Up to 50% reduction in application rates may be used when permanent vegetation is established prior to requesting a Report of Compliance from the district. These rates apply to all methods of seeding. Establishing permanent vegetation means 80% vegetative cover (of the seeded species) and mowed once.

Table 4-2
Permanent Stabilization Mixtures for Various Uses

Application	PLANTING MIXTURES BY SOIL DRAINAGE CLASS/¹ (see Table 4-3)		
	Excessively Drained	Well to Moderately Well Drained	Somewhat Poorly to Poorly Drained
Residential/commercial lots	12, 14, 17	12, 14, 15, 16, 17	18
Pond and channel banks, dikes, berms and dams	2, 7, 8, 12	7, 8, 9, 10, 11, 17	2, 10, 18, 19
Drainage ditches, swales, detention basins	2, 11, 13	2, 9, 11, 13, 14, 19	2, 10, 18, 19
Filter Strips	14	13, 14	13, 14
Grasses waterway, spillways	2,3,11, 12,14	8, 9, 11, 12, 13, 14	2,11,13,14
Recreation areas, athletic fields	7, 14, 17, 20	14, 15, 16, 17, 20	18
<u>Special Problem Sites</u>			
Steep slopes and banks, roadsides, borrow areas	2, 3, 6, 8	2, 3, 7, 9, 10, 11, 12, 17, 20	2, 11, 12, 13, 14
Sand and gravel pits, Sanitary landfills	1, 2, 3, 4, 5, 6,21	1, 2, 3, 4, 5, 6, 10, 17,20	2, 10
Dredged material, spoilbanks, Borrow areas	2, 3, 6, 20	2, 3, 6, 11,	2,10
Streambanks & shorelines ²	2, 10, 22, 23a	2, 10, 21b, 22, 23a,23b	2, 10, 21a, 23a,b,c,d
Utility rights-of-way	3, 9, 20	3, 9	10, 11, 19

1. Refer to Soil Surveys for drainage class descriptions.
2. Refer to Soil Bioengineering Standard for additional seed mixtures.
3. Spillways only
4. See Appendix E for description of turf grasses and cultivars

Table 4-3

PERMANENT VEGETATIVE MIXTURES, PLANTING RATES AND PLANTING DATES¹

SEED MIXTURE ²	PLANTING RATE ³		PLANTING DATES.									MAINTENANCE LEVEL ⁴	REMARKS
			O = Optimal Planting period A = Acceptable Planting period										
			PLANT HARDINESS ZONES (see Figure 4-1)										
			Zone 5b, 6a			Zone 6b			Zone 7a, 7b				
lbs/acre	lbs/1000 sq. ft.	3/15-5/31	6/1-7/31	8/1-10/31	3/1-4/30	5/1-8/14	8/15-11/15	2/1-4/30	5/1-8/14	8/15-11/30			
WARM SEASON SEED MIXTURES	15	.35										C-D	Serecia lespedeza not adapted to zone 5.
	15	.35											
	20	.45	O			O			O				
	20	.45											
1. Switchgrass and/or Coastal panicgrass plus Serecia lespedeza or Flatpea													
2. Deertongue or Switchgrass Redtop plus Birdsfoot trefoil	15	.35										C-D	Use Deertongue if pH < 4.0. Switchgrass is superior wildlife plant. Use for waterways. Redtop provides quick cover. Birdsfoot not adapted to zone 6b, 7a, 7b.
	20	.45	O			O			O				
	1	.1											
	10	.23											
3. Weeping lovegrass Flatpea or Serecia lespedeza	3	.10										C-D	Flatpea suppresses invading woody vegetation.
	25	.60	O	A		O	A		O	A			
	25	.60											

Table 4-3

PERMANENT VEGETATIVE MIXTURES, PLANTING RATES AND PLANTING DATES¹

SEED MIXTURE ²	PLANTING RATE ³		PLANTING DATES.									MAINTENANCE LEVEL ⁴	REMARKS
			O = Optimal Planting period A = Acceptable Planting period										
			PLANT HARDINESS ZONES (see Figure 4-1)										
			Zone 5b, 6a			Zone 6b			Zone 7a, 7b				
	lbs/acre	lbs/1000 sq. ft.	3/15- 5/31	6/1- 7/31	8/1- 10/31	3/1- 4/30	5/1- 8/14	8/15- 11/15	2/1- 4/30	5/1- 8/14	8/15- 11/30		
4. Switchgrass Deertongue Little Bluestem Sheep fescue plus Partridge pea	15 10 20 20 10	.35 .25 .45 .45 .25	O			O			O			C-D	Pinelands mixture.
5. Switchgrass Big Bluestem Little Bluestem Sand lovegrass Coastal panicgrass	10 5 5 4 10	.25 .10 .10 .10 .25	O			O			O			C-D	Native warm- season mixture.
6. Bermudagrass Zoysiagrass (seed) Zoysiagrass (sprigs)	15 30	0.35 0.70	O			O			O			A-D	Bermudagrass has superior salt tolerance. Zoysia has greater wear tolerance

Table 4-3

PERMANENT VEGETATIVE MIXTURES, PLANTING RATES AND PLANTING DATES¹

SEED MIXTURE ²	PLANTING RATE ³		PLANTING DATES.									MAINTENANCE LEVEL ⁴	REMARKS
			O = Optimal Planting period A = Acceptable Planting period										
			PLANT HARDINESS ZONES (see Figure 4-1)										
			Zone 5b, 6a			Zone 6b			Zone 7a, 7b				
	lbs/acre	lbs/1000 sq. ft.	3/15- 5/31	6/1- 7/31	8/1- 10/31	3/1- 4/30	5/1- 8/14	8/15- 11/15	2/1- 4/30	5/1- 8/14	8/15- 11/30		
7. Deertongue Weeping lovegrass Serecia lespedeza	20 3 25	.45 .10 .60	O	A	Before 8/30	O	A	Before 9/15	O	A	Before 9/30	C-D	Use this mix if pH <4.5 and toxic metals present.
COOL SEASON SEED MIXTURES													
8. Fine Fescue (Blend) Hard Fescue Strong Creeping Red Fescue Kentucky bluegrass Perennial ryegrass plus White clover	75 10 10 5	2.1 .25 .25 .10	O	A	O	O	A	O	O	A	O	B-D	General low maintenance mixture.

Table 4-3

PERMANENT VEGETATIVE MIXTURES, PLANTING RATES AND PLANTING DATES¹

SEED MIXTURE ²	PLANTING RATE ³		PLANTING DATES.									MAINTENANCE LEVEL ⁴	REMARKS
			O = Optimal Planting period A = Acceptable Planting period										
			PLANT HARDINESS ZONES (see Figure 4-1)										
			Zone 5b, 6a			Zone 6b			Zone 7a, 7b				
	lbs/acre	lbs/1000 sq. ft.	3/15- 5/31	6/1- 7/31	8/1- 10/31	3/1- 4/30	5/1- 8/14	8/15- 11/15	2/1- 4/30	5/1- 8/14	8/15- 11/30		
9. Strong Creeping red fescue Kentucky bluegrass Perennial ryegrass or Redtop plus White clover	60 40 10 3 5	1.4 .92 .25 .10 .10	O	A	O	O	A	O	O	A	O	B-D	Suitable waterway mix. Canada bluegrass more drought tolerant. Use Redtop for increased drought tolerance.
10. Tall fescue (turf-type) or Strong Creeping red fescue or Perennial ryegrass plus Crownvetch or Flatpea	20 20 20 25 25	.45 .45 .45 .60 .60	O	O	O	O	A	O	O	A	O	B-D	Tall fescue best selected for droughty conditions. Use Creeping red fescue in heavy shade. Use Flatpea to suppress woody vegetation.

Table 4-3

PERMANENT VEGETATIVE MIXTURES, PLANTING RATES AND PLANTING DATES¹

SEED MIXTURE ²	PLANTING RATE ³		PLANTING DATES.									MAINTENANCE LEVEL ⁴	REMARKS
			O = Optimal Planting period A = Acceptable Planting period										
			PLANT HARDINESS ZONES (see Figure 4-1)										
			Zone 5b, 6a			Zone 6b			Zone 7a, 7b				
	lbs/acre	lbs/1000 sq. ft.	3/15-5/31	6/1-7/31	8/1-10/31	3/1-4/30	5/1-8/14	8/15-11/15	2/1-4/30	5/1-8/14	8/15-11/30		
11. Deertongue Redtop Wild rye (Elymus) Switchgrass	20 2 15 25	.45 .05 .35 .60	O			O			O			C-D	Native wet mix.
12. Tall fescue (turf-type) Redtop or Perennial ryegrass Birdsfoot trefoil or White clover	50 5 5 10 5	1.1 .10 .10 .25 .10	O	A	O	O	A	O	O	A	O	C-D	Birdsfoot trefoil is best adapted to zone 5.
13. Reed canarygrass Kentucky Bluegrass Turf-type Tall fescue	25 60	0.60 1.4	O	A	O	O	A	O	O	A	O	C-D	Filter strip use for nutrient uptake.
14. Turf-type Tall fescue (Blend of 3 cultivars)	150	3.5	O	A	O	O	A	O	O	A	O	C-D	Use in a managed filter strip for nutrient uptake.
15. Hard Fescue Perennial ryegrass Ky. bluegrass (blend)	120 30 40	2.7 0.7 0.9	O	A	O	O	A	O	O	A	O	A-C	General lawn/recreation.

Table 4-3

PERMANENT VEGETATIVE MIXTURES, PLANTING RATES AND PLANTING DATES¹

SEED MIXTURE ²	PLANTING RATE ³		PLANTING DATES.									MAINTENANCE LEVEL ⁴	REMARKS
			O = Optimal Planting period A = Acceptable Planting period										
			PLANT HARDINESS ZONES (see Figure 4-1)										
			Zone 5b, 6a			Zone 6b			Zone 7a, 7b				
	lbs/acre	lbs/1000 sq. ft.	3/15- 5/31	6/1- 7/31	8/1- 10/31	3/1- 4/30	5/1- 8/14	8/15- 11/15	2/1- 4/30	5/1- 8/14	8/15- 11/30		
16. Tall fescue Ky. bluegrass (blend) Perennial ryegrass (blend)	160 20 20	3.7 0.50 0.50	O	A	O	O	A	O	O	A	O	A-B	Athletic field/Mix 3 cultivars. of Kentucky Bluegrass.
17. Hard fescue Creeping fescue Perennial ryegrass	120 30 10	2.7 0.7 .25	O	A	O	O	A	O	O	A	O	C-D	Low maintenance fine fescue lawn mix.
18. Rough bluegrass Strong Creeping red fescue	90 50	2.0 1.2	O	A	O	O	A	O	O	A	O	C-D	Moist shade.
19. Creeping bentgrass Creeping red fescue Alkali saltgrass	25 40 40	0.60 0.92 0.92	O	A	O	O	A	O	O	A	O	B-D	Use bentgrass under wetter conditions. Saltgrass will only persistent under saline conditions.

Table 4-3

PERMANENT VEGETATIVE MIXTURES, PLANTING RATES AND PLANTING DATES¹

SEED MIXTURE ²	PLANTING RATE ³		PLANTING DATES.									MAINTENANCE LEVEL ⁴	REMARKS
			O = Optimal Planting period A = Acceptable Planting period										
			PLANT HARDINESS ZONES (see Figure 4-1)										
			Zone 5b, 6a			Zone 6b			Zone 7a, 7b				
	lbs/acre	lbs/1000 sq. ft.	3/15- 5/31	6/1- 7/31	8/1- 10/31	3/1- 4/30	5/1- 8/14	8/15- 11/15	2/1- 4/30	5/1- 8/14	8/15- 11/30		
20. Hard or Sheeps fescue N. E. wildflower mixture	25 12	0.60 0.35	O	A	O	O	A	O	O	A	O	C-D	Regional Wildflower mix Hydroseeding not recommended.
21. a. Smooth cordgrass b. Saltmeadow cordgrass	veg veg					O	Before July 1		O	Before July 1		D	Planted in the intertidal zone. Planted above mean high tide.
22. American beachgrass Coastal panicgrass	veg 20	.45				Before April 1			O			D	Coastal panicgrass may be interseeded between rows of beachgrass.
23. a. Purpleosier willow b. Dwarf willow c. Redosier dogwood d. Silky dogwood	veg. veg. veg. veg.		Before May 10			Before May 10			Before May 1			D	Also refer to Chapters 16 and 18 of Engineering Field Handbook. USDA-NRCS

Footnotes:

1. See Appendix B for descriptions of turf grass mixtures and cultivars. The actual amount of warm season grass mixture used in Table 3 (seed mix 1-7) shall be adjusted to reflect the amount of Pure Live Seed (PLS) as determined by germination testing results. No adjustment is required for cool season grasses (seed mixtures 8-20).
2. Seeding mixtures and/or rates not listed above may be used if recommended by the local Soil Conservation District, Natural Resources Conservation Service; recommendations of Rutgers Cooperative Extension may be used if approved by the Soil Conservation District. Legumes (flatpea, crownvetch, trefoil, lespedeza) should be mixed with proper inoculant prior to planting.
3. Seeding rates specified are required when a report of compliance is requested prior to actual establishment of permanent vegetation. Up to 50% reduction in rates may be used when permanent vegetation is established prior to a report of compliance inspection. These rates apply to all methods of seeding. Establishing permanent vegetation means 80% vegetative coverage of the seeded area and mowed once. Grass seed mixture checked by the State Seed Analyst, New Jersey Department of Agriculture, Trenton, New Jersey, will assure the purchaser that the mixture obtained is the mixture ordered, pursuant to the N.J. State Seed Law, N.J.S.A. 4:8-17.13 et. seq.

O = optimal planting period A = acceptable planting period

4. **Maintenance Level:**
 - A: Intensive mowing, (2-4 days), fertilization, lime, pest control and irrigation (Examples - high maintenance lawns, commercial and recreation areas, public facilities).
 - B: Frequent mowing, (4-7 days), occasional fertilization, lime and weed control (Examples - home lawns, commercial sites, school sites).
 - C: Periodic mowing (7-14 days), occasional fertilization and lime (Examples - home lawns, parks).
 - D: Infrequent or no mowing, fertilization and lime the first year of establishment (Examples - roadsides, recreation areas, public open spaces).

Figure 4-1

USDA Plant Hardiness Zones

Average Annual Minimum Temperature
New Jersey

Hardiness Zones

Range of average annual
minimum temperatures for
each zone (degrees Fahrenheit)

Zone 5b (-10 to -15)

Includes portions of Sussex
and Warren counties

Zone 6a (-5 to -10)

Includes portions of Sussex,
Warren, Passaic, Morris, Somerset and
Hunterdon counties

Zone 6b (0 to -5)

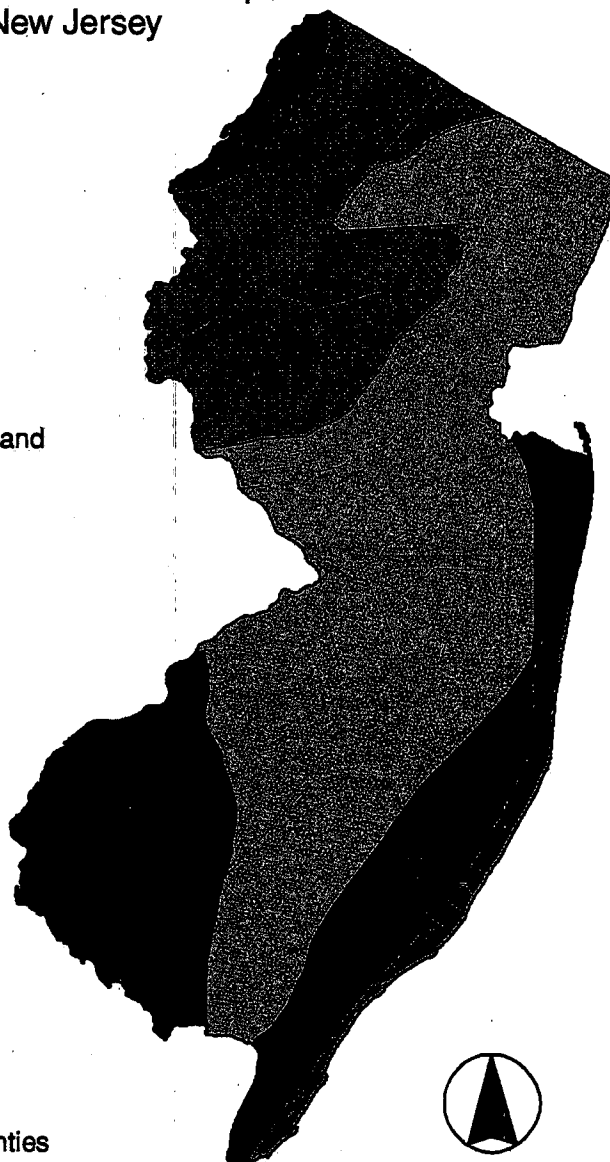
Includes portions of Bergen,
Passaic, Morris, Essex, Hudson,
Union, Somerset, Middlesex,
Mercer, Hunterdon, Monmouth,
Ocean, Burlington, Camden,
Gloucester, Atlantic, Cumberland
and Cape May counties

Zone 7a (5 to 0)

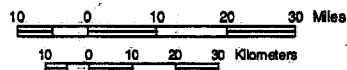
Includes portions of Camden,
Gloucester, Salem, Cumberland,
Cape May, Atlantic, Burlington,
Ocean and Monmouth counties

Zone 7b (10 to 5)

Includes portions of Cape May,
Atlantic, Ocean and Monmouth counties



After USDA-ARS Misc. Publication 1475
NJDA State Soil Conservation Committee
April 1999



**STANDARD
FOR
STABILIZATION WITH MULCH ONLY**

Definition

Stabilizing exposed soils with non-vegetative materials.

Purpose

To protect exposed soil surfaces from erosion damage and to reduce offsite environmental damage.

Water Quality Enhancement

Provides temporary mechanical protection against wind or rainfall induced soil erosion until permanent vegetative cover may be established.

Where Applicable

This practice is applicable to areas subject to erosion, where the season and other conditions may not be suitable for growing an erosion-resistant cover or where stabilization is needed for a short period until more suitable protection can be applied.

Methods and Materials

1. Site Preparation

- A. Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and mulch anchoring. All grading should be done in accordance with Standards for Land Grading, pg.19-1
- B. Install needed erosion control practices or facilities such as diversions, grade stabilization structures, channel stabilization measures, sediment basins, and waterways. See Standards 11 through 42.

2. Protective Materials

- A. Unrotted small-grain straw, or salt hay at 2.0 to 2.5 tons per acre is spread uniformly at 90 to 115 pounds per 1,000 square feet and anchored with a mulch anchoring tool, liquid mulch binders, or netting tie down. Other suitable materials may be used if approved by the Soil Conservation District.
- B. Asphalt emulsion is recommended at the rate of 600 to 1,200 gallons per acre. This is suitable for a limited period of time where travel by people, animals, or machines is not a problem.
- C. Synthetic or organic soil stabilizers may be used under suitable conditions and in quantities as recommended by the manufacturer.
- D. Wood-fiber or paper-fiber mulch at the rate of 1,500 pounds per acre (or according to the manufacturer's requirements) may be applied by a hydroseeder.

- E. Mulch netting, such as paper jute, excelsior, cotton, or plastic, may be used.
 - F. Woodchips applied uniformly to a minimum depth of 2 inches may be used. Woodchips will not be used on areas where flowing water could wash them into an inlet and plug it.
 - G. Gravel, crushed stone, or slag at the rate of 9 cubic yards per 1,000 sq. ft. applied uniformly to a minimum depth of 3 inches may be used. Size 2 or 3 (ASTM C-33) is recommended.
3. Mulch Anchoring - should be accomplished immediately after placement of hay or straw mulch to minimize loss by wind or water. This may be done by one of the following methods, depending upon the size of the area and steepness of slopes.
- A. Peg and Twine - Drive 8 to 10 inch wooden pegs to within 2 to 3 inches of the soil surface every 4 feet in all directions. Stakes may be driven before or after applying mulch. Secure mulch to soil surface by stretching twine between pegs in a criss-cross and a square pattern. Secure twine around each peg with two or more round turns.
 - B. Mulch Nettings - Staple paper, cotton, or plastic nettings over mulch. Use a degradable netting in areas to be mowed. Netting is usually available in rolls 4 feet wide and up to 300 feet long.
 - C. Crimper Mulch Anchoring Coulter Tool - A tractor-drawn implement especially designed to punch and anchor mulch into the soil surface. This practice affords maximum erosion control, but its use is limited to those slopes upon which the tractor can operate safely. Soil penetration should be about 3 to 4 inches. On sloping land, the operation should be on the contour.
- D. Liquid Mulch-Binders
- 1. Applications should be heavier at edges where wind catches the mulch, in valleys, and at crests of banks. Remainder of area should be uniform in appearance.
 - 2. Use one of the following:
 - a. Emulsified asphalt - (SS-1, CSS-1, CMS-2, MS-2, RS-1, RS-2, CRS-1, and CRS-2). Apply 0.04 gal./sq.yd. or 194 gal./acre on flat areas and on slopes less than 8 feet or more high, use 0.075 gal./sq. yd. or 363 gal./acre. These materials may be difficult to apply uniformly and will discolor surfaces.
 - b. Organic and Vegetable Based Binders - Naturally occurring, powder based, hydrophilic materials that mixed with water formulates a gel and when applied to mulch under satisfactory curing conditions will form membraned networks of insoluble polymers. The vegetable gel shall be physiologically harmless and not result in a phytotoxic effect or impede growth of turfgrass. Vegetable based gels shall be applied at rates and weather conditions recommended by the manufacturer.
 - c. Synthetic Binders - High polymer synthetic emulsion, miscible with water when diluted and following application to mulch, drying and curing shall no longer be soluble or dispersible in water. It shall be applied at rates and weather conditions recommended by the manufacturer and remain tacky until germination of grass.

**STANDARD
FOR
PERMANENT STABILIZATION WITH SOD**

Definition

Establishing permanent vegetation using sod.

Purpose

To permanently stabilize topsoil with an immediate aesthetic covering, thus assuring conservation of soil and water, and to enhance the environment.

Water Quality Enhancement

Provides an immediate, permanent vegetative cover to the soil from the impacts of wind or rain and prevents soil and nutrient losses to streams and other stormwater conveyances from stormwater runoff.

Where Applicable

On exposed soils that have a potential for causing off-site environmental damage where an immediate, permanent vegetative cover is desired. Moisture is required for success; access to irrigation is essential.

Methods and Materials

1. Cultivated sod is preferred over native or pasture sod. Specify "Certified Sod," or other high quality cultivated sod.
2. Sod should be free of weeds and undesirable coarse weedy grasses.
3. Sod should be of uniform thickness, approximately 5/8 inch, plus or minus 1/4 inch, at time of cutting (Excludes top growth.).
4. Sod should be vigorous and dense and be able to retain its own shape and weight when suspended vertically with a firm grasp from the upper 10 percent of the strip. Broken pads or torn and uneven ends will not be acceptable.
5. For droughty sites, a sod of turf-type tall fescue and bluegrass is preferred over a straight bluegrass sod.
6. Only moist, fresh, unheated sod should be used. Sod should be harvested, delivered, and installed within a period of 36 hours or less during summer months.
1. Site Preparation
 - A. Grade as needed and feasible to permit the use of conventional equipment for liming, fertilizing, and soil preparation. All grading should be done in accordance with Standard for

Land Grading, pg. 19-1.

- B. Install needed erosion control practices and facilities, such as diversion ditches,, dikes and terraces, erosion stops, and desilting basins. See Standards 11 through 42.

2. Soil Preparation

- A. Apply ground limestone and fertilizer according to soil test recommendations such as offered by Rutgers Co-operative Extension. Soil sample mailers are available from the local Rutgers Cooperative Extension offices. Fertilizer shall be applied at the rate of 500 pounds per acre or 11 pounds per 1,000 square feet using 10-20-10 or equivalent with 50% water insoluble nitrogen unless a soil test indicates otherwise. Apply limestone at the rate of 2 tons/acre unless soil testing indicates otherwise. Calcium carbonate is the equivalent and standard for measuring the ability of liming materials to neutralize soil acidity and supply calcium and magnesium to grasses and legumes. Table 6-1 is a general guideline for limestone application rates.

Table 6-1

Limestone ¹ Application Rate by Soil Texture		
SOIL TEXTURE	TONS/ACRE	LBS./1000 SQ. FT.
Clay, clay loam, and high organic soil	3	135
Sandy loam, loam, silt loam	2	90
Loamy sand, sand	1	45

1. Pulverized dolomitic limestone is preferred for most soils south of the New Brunswick-Trenton line.

- B. Work lime and fertilizer into the topsoil as nearly as practical to a depth of 4 inches with a disc, springtooth harrow, or other suitable equipment. The final harrowing or disking operation should be on the general contour. Continue tillage until a reasonably uniform, fine seedbed is prepared.
- C. Remove from the surface all objects that would prevent good sod to topsoil contact and remove all other debris, such as wire, cable, tree roots, pieces of concrete, clods, lumps, or other unsuitable material.
- D. Inspect site just before seeding. If traffic has left the soil compacted, the area must be retilled and firmed in accordance with the above.

3. Sod Placement

- A. Sod strips should be laid on the contour, never up and down the slope, starting at the bottom of the slope and working up. On steep slopes, the use of ladders will facilitate the work and prevent damage to the sod. During periods of high temperature, lightly irrigate the soil immediately prior to laying the sod.
- B. Place sod strips with snug, even joints that are staggered. Open spaces invite erosion.
- C. Roll or tamp sod immediately following placement to insure solid contact of root mat and soil surface. Do not overlap sod. All joints should be butted tightly in order to prevent voids which would cause drying of the roots.
- D. On slopes greater than 3 to 1, secure sod to surface soil with wood pegs, wire staples biodegradable plastic spikes, or split shingles (8 to 10 inches long by 3/4 inch wide).
- E. Surface water cannot always be diverted from flowing over the face of the slope, but a capping strip of heavy jute or plastic netting, properly secured, along the crown of the slope and edges will provide extra protection against lifting and undercutting of sod. The same technique can be used to anchor sod in water-carrying channels and other critical areas. Wire staples must be used to anchor netting in channel work.
- F. Immediately following installation, sod should be watered until moisture penetrates the soil layer beneath sod to a depth of 1 inch. Maintain optimum moisture for at least two weeks.

4. Topdressing - Since slow release nitrogen fertilizer (water insoluble) is prescribed in Section 2, "Seedbed Preparation" in this Standard, a follow-up topdressing is not mandatory, except where gross nitrogen deficiency exists to the extent that turf failure may develop, topdressing shall then be applied. Topdress with 10-10-10 or equivalent at 400 pounds per acre or 10 pounds per 1,000 square feet.

**STANDARD
FOR
TEMPORARY VEGETATIVE COVER FOR SOIL STABILIZATION**

Definition

Establishment of temporary vegetative cover on soils exposed for periods of two to 6 months which are not being graded, not under active construction or not scheduled for permanent seeding within 60 days.

Purpose

To temporarily stabilize the soil and reduce damage from wind and water erosion until permanent stabilization is accomplished.

Water Quality Enhancement

Provides temporary protection against the impacts of wind and rain, slows the over land movement of stormwater runoff, increases infiltration and retains soil and nutrients on site, protecting streams or other stormwater conveyances.

Where Applicable

On exposed soils that have the potential for causing off-site environmental damage.

Methods and Materials

1. Site Preparation

- A. Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and mulch anchoring. All grading should be done in accordance with Standards for Land Grading, pg. 19-1.
- B. Install needed erosion control practices or facilities such as diversions, grade stabilization structures, channel stabilization measures, sediment basins, and waterways. See Standards 11 through 42.
- C. Immediately prior to seeding, the surface should be scarified 6" to 12" where there has been soil compaction. This practice is permissible only where there is no danger to underground utilities (cables, irrigation systems, etc.).

2. Seedbed Preparation

- A. Apply ground limestone and fertilizer according to soil test recommendations such as offered by Rutgers Co-operative Extension. Soil sample mailers are available from the local Rutgers Cooperative Extension offices. Fertilizer shall be applied at the rate of 500 pounds per acre or 11 pounds per 1,000 square feet of 10-20-10 or equivalent with 50% water insoluble nitrogen unless a soil test indicates otherwise. Apply limestone at the rate of 2 tons/acre unless soil testing indicates

otherwise. Calcium carbonate is the equivalent and standard for measuring the ability of liming materials to neutralize soil acidity and supply calcium and magnesium to grasses and legumes. Table 7-1 is a general guideline for limestone application.

TABLE 7-1

Limestone ¹ Application Rate by Soil Texture		
SOIL TEXTURE	TONS/ACRE	LBS./1000 SQ. FT.
Clay, clay loam, and high organic soil	3	135
Sandy loam, loam, silt loam	2	90
Loamy sand, sand	1	45

1. Pulverized dolomitic limestone is preferred for most soils south of the New Brunswick-Trenton line.

- B. Work lime and fertilizer into the soil as nearly as practical to a depth of 4 inches with a disc, springtooth harrow, or other suitable equipment. The final harrowing or discing operation should be on the general contour. Continue tillage until a reasonable uniform seedbed is prepared.
- C. Inspect seedbed just before seeding. If traffic has left the soil compacted, the area must be retilled in accordance with the above.
- D. Soils high in sulfides or having a pH of 4 or less refer to Standard for Management of High Acid Producing Soils, pg. 1-1.

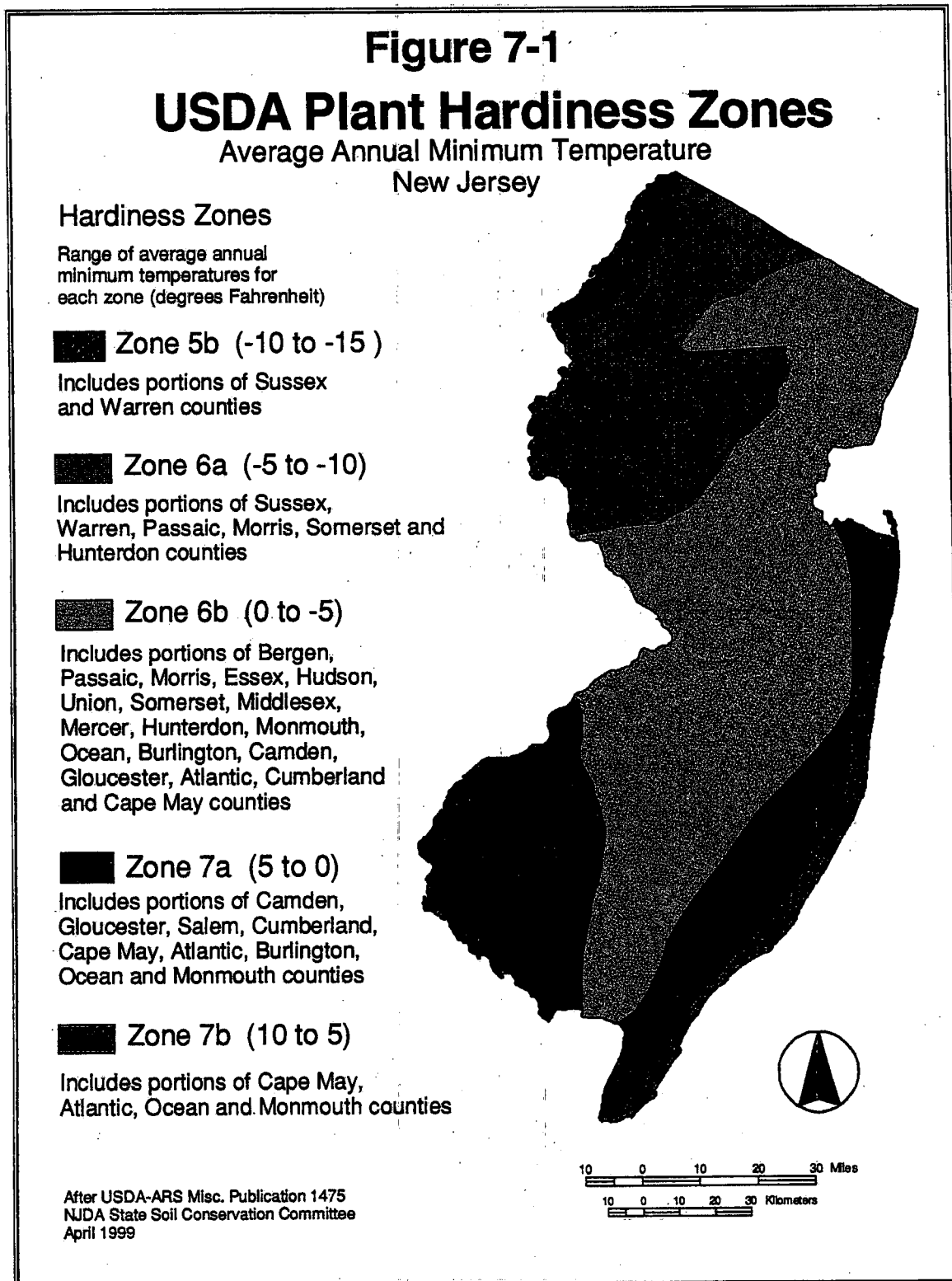
3. Seeding

- A. Select seed from recommendations in Table 7-2.

TABLE 7-2**TEMPORARY VEGETATIVE STABILIZATION GRASSES, SEEDING RATES, DATES AND DEPTH.**

SEED SELECTIONS	SEEDING RATE ¹ (pounds)		OPTIMUM SEEDING DATE ² Based on Plant Hardiness Zone ³			OPTIMUM SEED DEPTH ⁴ (inches)
	Per Acre	Per 1000 Sq. Ft.	ZONE 5b, 6s	ZONE 6b	ZONE 7a, b	
COOL SEASON GRASSES						
1. Perennial ryegrass	100	1.0	3/15-6/1 8/1-9/15	3/1-5/15 8/15-10/1	2/15-5/1 8/15-10/15	0.5
2. Spring oats	86	2.0	3/15-6/1 8/1-9/15	3/1-5/15 8/15-10/1	2/15-5/1 8/15-10/15	1.0
3. Winter Barley	96	2.2	8/1-9/15	8/15-10/1	8/15-10/15	1.0
4. Winter Cereal Rye.	112	2.8	8/1 - 11/1	8/1 - 11/15	8/1 - 12/15	1.0
WARM SEASON GRASSES						
5. Pearl millet	20	0.5	6/1-8/1	5/15-8/15	5/1-9/1	1.0
6. Millet (German or Hungarian)	30	0.7	6/1-8/1	5/15-8/15	5/1-9/1	1.0
7. Weeping lovegrass	5	0.2	6/1-8/1	5/15-8/15	5/1-9/1	0.25

- 1 Seeding rate for warm season grass, selections 5 - 7 shall be adjusted to reflect the amount of Pure Line Seed (PLS) as determined by a germination test result. No adjustment is required for cool season grasses.
- 2 May be planted throughout summer if soil moisture is adequate or seeded area can be irrigated.
- 3 Plant Hardiness Zone (see figure 7-1, pg. 7-4.)
- 4 Twice the depth for sandy soils



- B. Conventional Seeding. Apply seed uniformly by hand, cyclone (centrifugal) seeder, drop seeder, drill or cultipacker seeder. Except for drilled, hydroseeded or cultipacked seedings, seed shall be incorporated into the soil, to a depth of 1/4 to 1/2 inch, by raking or dragging. Depth of seed placement may be 1/4 inch deeper on coarse textured soil.
- C. Hydroseeding is a broadcast seeding method usually involving a truck or trailer mounted tank, with an agitation system and hydraulic pump for mixing seed, water and fertilizer and spraying the mix onto the prepared seedbed. Mulch shall not be included in the tank with seed. Short fibered mulch may be applied with a hydroseeder following seeding. (also see Section IV Mulching) Hydroseeding is not a preferred seeding method because seed and fertilizer are applied to the surface and not incorporated into the soil. Poor seed to soil contact occurs reducing seed germination and growth. Hydroseeding may be used for areas too steep for conventional equipment to traverse or too obstructed with rocks, stumps, etc.
- D. After seeding, firming the soil with a corrugated roller will assure good seed-to-soil contact, restore capillarity, and improve seedling emergence. This is the preferred method. When performed on the contour, sheet erosion will be minimized and water conservation on site will be maximized.

4. Mulching

Mulching is required on all seeding. Mulch will insure against erosion before grass is established and will promote faster and earlier establishment. The existence of vegetation sufficient to control soil erosion shall be deemed compliance with this mulching requirement.

- A. Straw or Hay. Unrotted small grain straw, hay free of seeds, or salt hay to be applied at the rate of 1-1/2 to 2 tons per acre (70 to 90 pounds per 1,000 square feet), except that where a crimper is used instead of a liquid mulch-binder (tackifying or adhesive agent), the rate of application is 3 tons per acre. Mulch chopper-blowers must not grind the mulch. Hay mulch is not recommended for establishing fine turf or lawns due to the presence of weed seed.

Application. Spread mulch uniformly by hand or mechanically so that approximately 85% of the soil surface will be covered. For uniform distribution of hand-spread mulch, divide area into approximately 1,000 square feet sections and distribute 70 to 90 pounds within each section.

Anchoring shall be accomplished immediately after placement to minimize loss by wind or water. This may be done by one of the following methods, depending upon the size of the area, steepness of slopes, and costs.

1. Peg and Twine. Drive 8 to 10 inch wooden pegs to within 2 to 3 inches of the soil surface every 4 feet in all directions. Stakes may be driven before or after applying mulch. Secure mulch to soil surface by stretching twine between pegs in a criss-cross and a square pattern. Secure twine around each peg with two or more round turns.
2. Mulch Nettings. Staple paper, jute, cotton, or plastic nettings to the soil surface. Use a

degradable netting in areas to be mowed.

3. Crimper (mulch anchoring coulter tool). A tractor-drawn implement, somewhat like a disc harrow, especially designed to push or cut some of the broadcast long fiber mulch 3 to 4 inches into the soil so as to anchor it and leave part standing upright. This technique is limited to areas traversable by a tractor, which must operate on the contour of slopes. Straw mulch rate must be 3 tons per acre. No tackifying or adhesive agent is required.
4. Liquid Mulch-Binders. - May be used to anchor salt hay, hay or straw mulch.
 - a. Applications should be heavier at edges where wind may catch the mulch, in valleys, and at crests of banks. The remainder of the area should be uniform in appearance.
 - b. Use one of the following:
 - (1) Emulsified asphalt - (SS-1, CSS-1, CMS-2, MS-2, RS-1, RS-2, CRS-1, and CRS-2). Apply 0.04 gal./sq.yd. or 194 gal./acre on flat areas and on slopes less than 8 feet or more high, use 0.075 gal./sq. yd. or 363 gal./acre. These materials may be difficult to apply uniformly and will discolor surfaces.
 - (2) Organic and Vegetable Based Binders - Naturally occurring, powder based, hydrophilic materials when mixed with water formulates a gel and when applied to mulch under satisfactory curing conditions will form membraned networks of insoluble polymers. The vegetable gel shall be physiologically harmless and not result in a phytotoxic effect or impede growth of turfgrass. Use at rates and weather conditions as recommended by the manufacturer to anchor mulch materials. Many new products are available, some of which may need further evaluation for use in this state.
 - (3) Synthetic Binders - High polymer synthetic emulsion, miscible with water when diluted and following application to mulch, drying and curing shall no longer be soluble or dispersible in water. It shall be applied at rates recommended by the manufacturer and remain tacky until germination of grass.

Note: All names given above are registered trade names. This does not constitute a recommendation of these products to the exclusion of other products.

- B. Wood-fiber or paper-fiber mulch. Shall be made from wood, plant fibers or paper containing no growth or germination inhibiting materials, used at the rate of 1,500 pounds per acre (or as recommended by the product manufacturer) and may be applied by a hydroseeder. This mulch shall not be mixed in the tank with seed. Use is limited to flatter slopes and during optimum seeding periods in spring and fall.
- C. Pelletized mulch. compressed and extruded paper and/or wood fiber product, which may contain co-polymers, tackifiers, fertilizers and coloring agents. The dry pellets, when applied to a seeded area and watered, form a mulch mat. Pelletized mulch shall be applied in accordance with the

manufacturers recommendations. Mulch may be applied by hand or mechanical spreader at the rate of 60-75 lbs/1,000 square feet and activated with 0.2 to 0.4 inches of water. This material has been found to be beneficial for use on small lawn or renovation areas, seeded areas where weed-seed free mulch is desired or on sites where straw mulch and tackifier agent are not practical or desirable.

Applying the full 0.2 to 0.4 inches of water after spreading pelletized mulch on the seed bed is extremely important for sufficient activation and expansion of the mulch to provide soil coverage.